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(71) Applicant *(for all designated States except US)*: NORDS VERKSTADS AKTIEBOLAG [SE/SE]; Box 85, S-660 60 Molkom (SE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : LUND, Per, Ivar [SE/SE]; Getbergsliden 4, S-654 81 Karlstad (SE). ARVIDSSON, Tomas [SE/SE]; Storgatan 85, S-582 28 Linköping (SE).

(74) Agent: HYNELL, Magnus; Hynell Patenttjänst AB, Box 236, S-683 02 Hagfors (SE).

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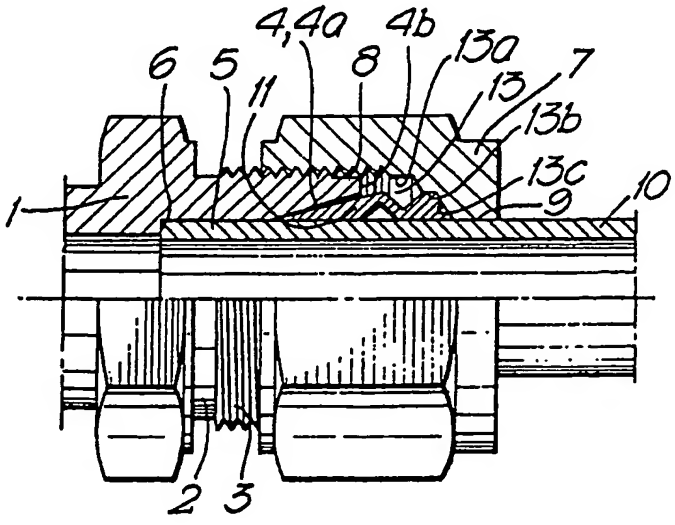

(57) Abstract

The present invention relates to a pipe coupling, designed as a thread jointing having a male part (1), a female part (7) and a jointing ring (11), disposed therebetween, which parts are coaxially disposed and penetrated by the coaxially disposed pipe (10), which is to be connected, said jointing ring comprising a front portion (12) with a front conical rotation-symmetrical surface (12a), which abuts an also conical internal surface (4a) in said male part, a rear rigid portion (20) in contact with said female portion as well as a deformation-portion (15), which is positioned between said front and said rear portions and designed to be able to be deformed when subjected to forces in the axial direction. Said deformation-portion (15) is designed as a comparatively thin wall (21), which connects the external periphery of said front portion (at 18) with the internal periphery of said rear portion (at 17).

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Tube Coupling

The present invention relates to a pipe coupling, which is used to connect a pipe having a circular cross-section, which pipe coupling comprises a thread jointing having a male part, a female part and a jointing ring disposed therebetween, which parts are coaxially disposed and penetrated by the coaxially disposed pipe, which is to be connected. More particularly, the invention relates to a pipe coupling, in which said jointing ring comprises a front portion having a front conical rotation-sym metrical surface, which front portion abuts an internal surface of said male part, which is also conical, a rear rigid portion in contact with said female part as well as a deformation-portion, which is placed between said front and said rear protions and designed to be deformed when subjected to forces in the axial direction.

SE-C-87 749, SE-C-144 051 and SE-C-351 023 relate to couplings, which are designed with an externally threaded male part having an internal rotation-symmetrical taper as well as an internally threaded female part, said two parts being bored through with a cylindrical hole having the same diameter as the tube, which is to be connected. A jointing ring is disposed therebetween and has an internal diameter, which corresponds to the external pipe diameter, and an external rotation-symmetrical taper, which is directed against said male part and fits into the taper of said male part with a possible conical angular deviation. Furthermore, the rear portion of said jointing ring abuts the female part of said coupling. When the coupling has been connected to the pipe, which extends through said three parts, and the threaded jointing is tightened, the front edge of the jointing ring will, with a wedge-action, penetrate the interface between said male part and said pipe and consequently, said front edge will effect a tightening between said parts.

Said three patents set forth various embodiments as to how the jointing ring is to be designed and the main effort is to be able to master the axial stress on the pipe, which is produced by the pressure of the medium (fluid). Thus, the front edge of the ring can be designed with one or several lips, and a hardening of the ring is also known, in order to give said lips a cutting action on the pipe, which is made of a softer material, and consequently a reliable fastening. Unfortunately, the jointing will be unresilient in this way and for that reason sensitive to vibrations, while the hardening reduces the corrosion resistance.

Pipe couplings with a jointing ring, which between its two ends has a deformation-portion, are also known, e.g. through FR-A-1 081 892 and US-A-2 100 796. The jointing ring according to said French patent has in each end wedge-shaped conical portions, which cooperate with corresponding internal conical jointing surfaces on the male and the female parts, as well as a central deformation-portion, while said US patent has a jointing ring, which is corrugated, i.e. has a wave design in the axial cross-sections. The ends are inclined but not markedly wedge-shaped. As to the construction according to said French patent there is a risk of a wedge-action in the two ends of the jointing ring against the respective portions of the male and the female parts, and in that way the desirable deformation of the central portion of the ring is jeopardized. The jointing, between the pipe wall and the internal surface of the jointing ring, which one tries to attain by a deformation and the clamping action obtained in this way, is then also jeopardized. On the other hand, when using the coupling according to said US patent, there is a risk, that no satisfactory jointing is obtained between the external surface of the jointing ring and that part of the coupling, against which

the external surface of said coupling abuts in the end adjacent the pipe end.

Also, it is known to make pipe couplings with two jointing rings, which are positioned adjacent each other, the object of which mainly is to create two cuts or waist deformations in the envelope surface of the pipe and in this way to make the pipe coupling more leakproof and above all to resist the axial stress on the coupling. The principal drawback of these pipe couplings is the fact that they are complicated to handle and to produce. Their demand for manufacturing tolerances is very severe for instance.

A brief description of the invention

The object of the present invention is to suggest an improved pipe coupling of the type set forth in the preamble of the main claim. More particularly, one object is to suggest a pipe coupling with essentially the same advantages as that above-described pipe coupling, which comprises two jointing rings positioned adjacent each other, which provides a more vibration-resistant coupling, which can be made of the same material as the pipe and has an improved resistance to axial stresses on the jointing but which does not have those drawbacks, which a two part coupling ring results in.

Those and other objects can be attained by designing the deformation-portion as a comparatively thin, inclined wall, which connects the external periphery of the front portion to the internal periphery of the rear portion. When, due to the contraction of the coupling, the front and the rear portions of the jointing ring are approacing each other during the deformation of the deformation-portion, said wall is forced to rise and be positioned in a more vertical position, and in this way its

internal periphery will move in a radial direction inwards and penetrate into the pipe and in this way effect the above-mentioned second waist formation in the pipe wall. Thanks to this penetration, which results in said second waist formation, a sufficient fastening is attained of the jointing ring in the pipe wall to resist the stress in the axial direction.

In order to let the collapse of the deformation-portion occur mainly in the radial direction inwards and not outwards, it is important that that front ring portion which is fastened to the external periphery of the wall be held up by the conical internal surface of the male part. Hence, according to another aspect of the invention, the internal conical portion of the male part will extend essentially up to the rear abut point of the front portion against the pipe wall or longer, before the coupling has been tightened.

Since the front portion of the ring preferably is provided with a somewhat smaller taper than the conical internal surface of the male part in order to attain an improved penetration capacity, it is important that the deformation-portion has a sufficient rigidity to prevent its collapse, before said front portion has penetrated into the pipe a sufficient distance in order to give the conical surface a fully leakproof contact. This rigidity can be attained by a combination of an appropriate wall thickness and appropriate geometrical dispositions. The latter feature implies i.a. that the wall suitably is inclined forwards and outwards but that it for the rest is straight, i.e. not is folded.

Additional characterizing features and aspects of the invention are set forth in the following patent claims as well as in the following description of two preferred embodiments.

A brief description of the drawings

The present invention will be explained in greater detail in the following description, reference being made to the accompanying drawings, in which:

Fig. 1 is a lateral view and a partial section of the composite pipe coupling according to a first preferred embodiment before a tightening;

Fig. 2 shows the same coupling, roughly half tightened;

Fig. 3 shows the coupling fully tightened;

Fig. 4 shows a jointing ring according to the first preferred embodiment on a larger scale;

Fig. 5 shows a jointing ring according to a second possible embodiment of the invention; and

Figs. 5A, 5B and 5C show a few encircled details in Fig. 5 on a larger scale.

A description of preferred embodiments

The pipe coupling shown in Figs. 1-3 comprises a male part 1 having a cylinder-shaped section 2, which is provided with an external thread 3 as well as in its end an annular first cut 4 having an internal taper 4a, which is designed to widen towards the open end of male part 1 up to a front edge 4b. Inside first cut 4 having a taper 4a a second cut 5 is provided, which is cylinder-shaped and is terminated with an annular edge or stop face 6.

A nut-shaped female part 7 having an internal thread 8 is in Fig. 1 screwed in on the external cylinder-shaped section 2 of male part 1. Female part 7 is provided with a cylinder-shaped opening 9 at its end turned away from male part 1, which opening has a diameter which corresponds with the external diameter of a pipe 10, which has been inserted into said pipe coupling. Pipe 10 is inserted to such an extent that it abuts internal annular edge 6 in male part 1. Finally, a jointing ring 11 is mounted on pipe 10 between male part 1 and female part 7 in a space

13, which inwards is limited by the pipe wall, forwards is limited by front edge 4b of male part 1 and by tapered surface 4b of cut 4 of the male part, outwards is limited by a first internal cylindric surface 13a in female part 7 and by a second cylindric surface 13b having a slightly smaller diameter than first cylindric surface 13a, and backwards is limited by a tapered press surface 13a on female part 7, which is inclined from second rear cylindric surface 13b towards cylinder-shaped opening 9 with an angle of 30° in relation to a radial plane.

The end of jointing ring 11 which is turned towards male part 1 is, in the present description and the patent claims, called the front end, while the opposite end is called the rear end. Said jointing ring is shown in detail in Fig. 4. It is provided in its front end with a front wedge-shaped conical portion 12 having an external conical surface 12a, which has an angle of about 15° in relation to a radial plane, which is slightly smaller than the corresponding angle of internal taper 4a of male part 1. An opening 14 extends through jointing ring 11 and has a diameter, which corresponds with the external diameter of pipe 10.

In its rear end jointing ring 11 has a homogenous rigid rear portion 20 having an external conical surface, which abuts press surface 13a of female part 7 and has the same conical angle as this part.

Between front wedge-shaped conical portion 12 and the rear more blunt rigid end portion 20 a deformation-portion 15 is provided, which is designed as a comparatively thin wall 21. The word comparatively implies that the wall is substantially thinner than the material in said front and rear portions. Said wall connects the outer periphery of front portion 12 with the inner periphery of rear rigid portion 20, i.e. wall 21 extends between partly

transition 18 between front portion 18 and deformation-portion 15 and partly front abut point 17 of rear portion 20 against the pipe wall, i.e. the point which forms a transition between rear portion 20 and deformation-portion 15. On the one side wall 21 is surrounded by an inner annular groove 16 having a triangular cross-section and on the other side by an outer V-shaped annular groove 19. Wall 21 can also be defined in this way: It extends from front abut point 17 of rear portion 20 forwards and upwards to transition 18 between front portion 12 and deformation-portion 15. The angle of inclination of wall 21 is 30-60°, before deformation-portion 15 has been deformed in conjunction with the tightening.

In its not yet tightened condition, Fig. 1, jointing ring 11 is, with its front conical portion 12, inserted into male part 1 to such an extent, that front edge 4b of the male part is positioned substantially at the same level - in the axial direction - as rear abut point 12b of front portion 12 against the pipe wall. When the coupling is tightened, front ring portion 12 will in this way be held up against conical surface 4a of male part 1.

Fig. 2 shows how the coupling has been half tightened and in this way forced front portion 12 of jointing ring 11 to, while being held up against conical surface 4a of male part 1, penetrate into the interface between pipe 10 and male part 1 and bring about an efficient tightening between the same. Consequently, during this tightening step a relative movement between jointing ring 11 and male part 1 takes place and thus, at the end of this step front edge 4b of male part 1 is positioned substantially at the same level as said transition 18 between front portion 12 of the ring and wall 21, Fig. 2. The penetration of front portion 12 of ring 11 into the pipe wall results in a first front waist formation 22 in the pipe wall, Fig. 2.

During this movement up to the position shown in Fig. 2 conical front portion 12 of ring 11 will fully contact conical internal surface 4 of male part 1, which in this way supports deformation-zone 15 in a radial direction.

When the tightening of the coupling is continued, front portion 12 of jointing ring 11 will not penetrate deeper into male part 1 or into the pipe wall. Deformation-portion 15 will instead collapse. Deformation-portion 15 has during the initial step of the tightening, i.e. up to the formation of the tightening waist formation 22, Fig. 2, had a sufficient rigidity to resist the deformation. During the continued tightening the deformation forces in the axial direction will increase and consequently, the deformation resistance of deformation-portion 15 will be overcome. When the deformation is attained in this way, the direction of wall 21 will turn increasingly vertical, while the abut point of wall 21, which corresponds to front abut point 17 of rear portion 20, will penetrate into the pipe wall and bring about a second rear waist formation 23, Fig. 3. During the deformation process wall 21 is prevented from instead moving in a radial direction outwards by the support of front portion 12 of the jointing ring on its external side against radially outwardly directed movements of the male part up to the peripherical portion of wall 21, i.e. transition 18. This second waist formation 23 has brought about such a reliable fastening of jointing ring 11 in the pipe wall, that all normal axial stresses on the jointing will be resisted and a very satisfactory vibration-resistant tightening at the same time be accomplished.

Fig. 5 shows a modified embodiment of a jointing ring. In this figure the same reference numerals as in Figs. 1-4 for the corresponding elements have been used, suffix ' being used.

The difference between this embodiment and the embodiment described above resides in that front conical portion 12' as well as rear rigid portion 20' have been provided with internal cuts 12c' and 20c' respectively. Cut 12c' renders front conical portion 12' slightly more flexible in order to facilitate its deformation and penetration into the pipe wall during the first step of the pipe coupling tightening process. Rear cut 20c' renders the front common abut point 17' of wall 21' and rear portion 20' against pipe 10 more marked. On the other hand, rear portion 20' will be slightly less rigid than a corresponding fully homogenous portion, but more rigid than deformation-portion 15'/wall 21'. In order to compensate for the slightly reduced rigidity of rear portion 20', the same has been made more inclined in relation to the radial plane than in the previous embodiment. Thus, the angle between the external surface of portion 20' and the radial plane is in this case 60°, shile a 45° inclination of the corresponding angle of the previous embodiment is used.

Patent claims

1. A pipe coupling, designed as a thread jointing having a male part (1); a female part (7) and a jointing ring (11) disposed therebetween, which parts are coaxially disposed and penetrated by the coaxially disposed pipe (10), which is to be connected, said jointing ring comprising a front portion (12) with a front conical rotation-symmetrical surface (12a), which abuts an also conical internal surface (4a) in said male part, a rear rigid portion (20) in contact with said female part as well as a deformation-portion (15), which is positioned between said front and said rear portions and designed to be deformed when subjected to forces in the axial direction, c h a r a c t e r i z e d in that said deformation-portion (15) is designed as a comparatively thin wall (21), which connects the external periphery of said front portion (at 18) with the internal periphery of said rear portion (at 17).

2. A pipe coupling according to claim 1, c h a r a c t e r i z e d in that the rigidity of said deformation-portion (15) is sufficient to resist the tightening forces in the axial direction during the first step of the tightening process, during which the front conical portion of said jointing ring penetrates into the pipe wall in order to effect a first front waist formation (22) adjacent the lip of said front portion, while the rigidity of said deformation portion is insufficient to resist more elevated axial tightening forces during the continued tightening process, subsequent to the formation of said first waist formation (22), and in that in this way the inclination of said wall in relation to the symmetrical line of said pipe will, from an initial inclination, be successively increased, the rear/internal portion of said wall in this way penetrating inwards in a radial direction, a second waist formation in said pipe being attained.

AMENDED CLAIMS
[received by the International Bureau on 15 August 1989 (15.08.89)
original claims 1 and 2 replaced by amended claim 1 (1 page)]

A pipe coupling, designed as a thread jointing having a male part (1), a female part (7) and a jointing ring (11) disposed therebetween, which parts are coaxially disposed and penetrated by the coaxially disposed pipe (10), which is to be connected, said jointing ring comprising a front portion (12) with a front conical rotation-symmetrical surface (12a), which abuts an also conical internal surface (4a) in said male part, a rear rigid portion (20) in contact with said female part as well as a deformation-portion (15), which is positioned between said front and said rear portions and designed to be deformed when subjected to forces in the axial direction, and wherein the rigidity of said deformation-portion (15) is sufficient to resist the tightening forces in the axial direction during the first step of the tightening process, during which the front conical portion of said jointing ring penetrates into the pipe wall in order to effect a first front waist formation (22) adjacent the lip of said front portion, while the rigidity of said deformation is insufficient to resist more elevated axial tightening forces during the continued tightening process, subsequent to the formation of said first waist formation (22), resulting in a second waist formation in said pipe, c h a r a c t e r i s e d in that said deformation-portion (15) is designed as a comparatively thin wall (21), which connects the external periphery of said front portion (at 18) with the internal periphery of said rear portion (at 17), said thin wall sloping from said external periphery of said front portion inwards and backwards toward the internal periphery of said rear portion, such that under the press from said elevated axial tightening forces during the continued tightening process, the inclination of said thin sloping wall in relation to the symmetrical line of said pipe will, from the initial sloping inclination, be successively increased, the rear/internal portion of said wall in this way penetrating inwards in a radial direction, forming said second waist formation in said pipe.

Fig. 1.

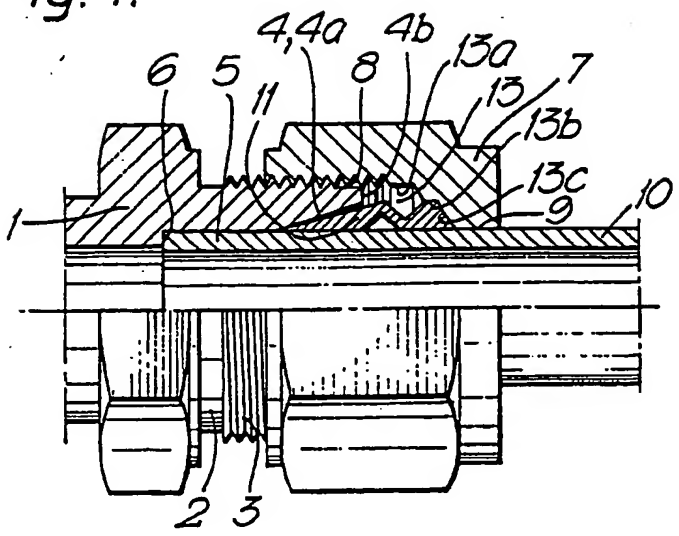


Fig. 2.

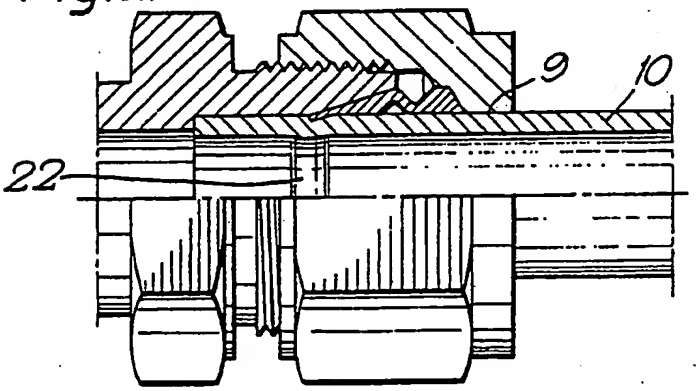


Fig. 3.

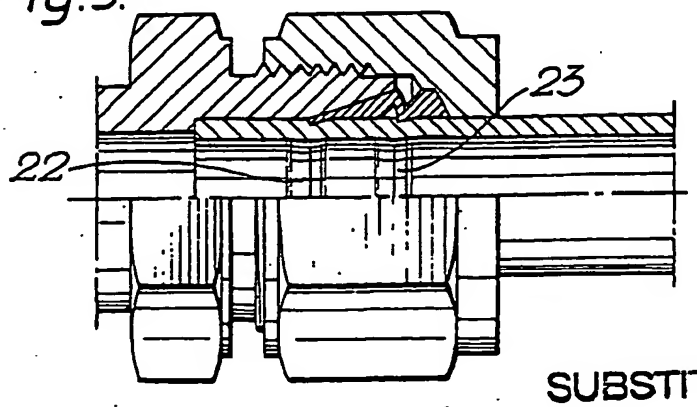


Fig.4.

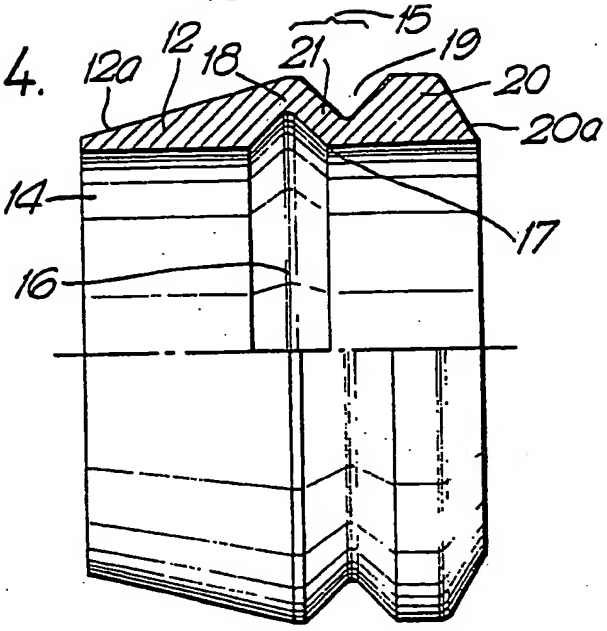


Fig.5a.

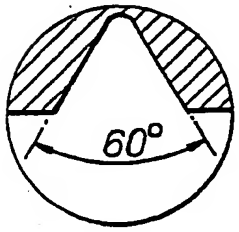


Fig.5b.

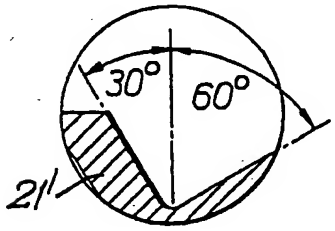


Fig.5c.

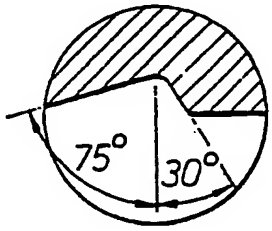
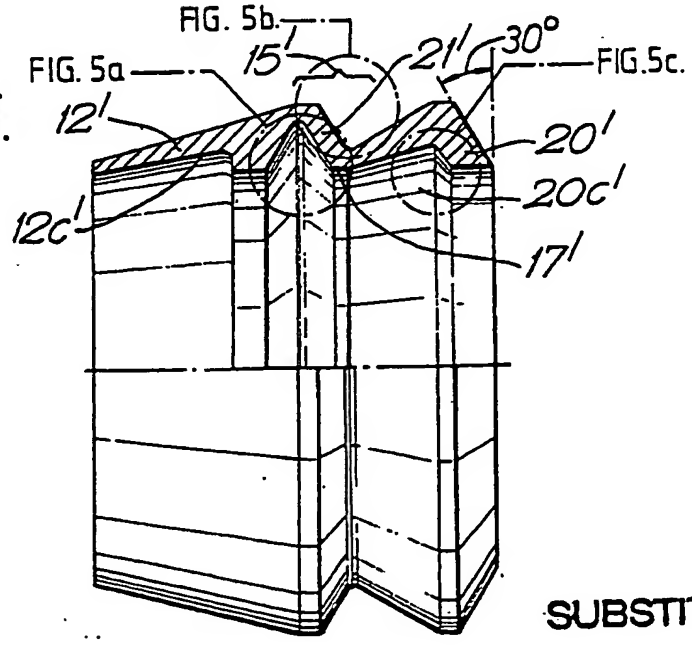


Fig.5.



SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE89/00182

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

F 16 L 19/06

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	F 16 L 19/00, /06-/08
US Cl	285:232, 249, 323, 339-343

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	SE, A, 86 771 (AKTIEBOLAGET NORDISKA ARMATUR-FABRIKERNA) 7 July 1936	
A	FR, A, 1 081 892 (JACQUES MULLER) 23 December 1954	
A	EP, A2, 0 034 493 (GOULD INC.) 26 August 1981	
A	EP, A3, 0 034 493 (GOULD INC.) 26 August 1981	
A	US, A, 2 100 796 (L H CHURCH) 30 November 1937	
A	US, A, 2 450 170 (G G SMITH) 28 September 1948	
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1989-06-02	1989 -06- 19
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Axel Lindhult

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4 556 242 (KOWAL ET AL) 3 December 1985	
X	US, A, 4 586 731 (CASTRUP) 6 May 1986 See whole document & EP, 0140060 DE, 3333866 JP, 60151495	1